Can Utilities Use Renewable Energy to Participate in Carbon Markets?

Eighth National Green Power Marketing Conference

Chicago, Illinois

November 3 – 5, 2003

Dr. Adam Serchuk, Primen

Dr. Evan Hughes, consultant to EPRI

Dr. Terry Peterson, EPRI

The main points for utilities

- Possible future GHG policies = regulatory risk
- Renewables competitive as a GHG strategy
  - Can offset significant fraction of utility emissions after 2020
  - Less economic and environmental risk than alternative measures
  - Necessary part of long-term utility GHG strategy
- But will utility projects qualify to participate in carbon markets?
  - Maybe not: Key issue is “additionality”

Who we are

EPRI

- Non-profit consortium
  - Science- and technology-based energy solutions
  - Collaborative research
- Key assets:
  - *Technical Assessment Guide – Renewable Energy*
  - *Greenhouse Gas Reduction with Renewables*

primen

- Member of the EPRI Family of Companies
- Business intelligence on retail energy sector
  - Subscription-based
  - Customized
- New offering: *Renewable Energy Information Service*

From our *Renewable Energy Information Service*

Renewable
Perspective

EPRI primen

RE-PP-01, August 2003

How Much Can Renewables Contribute as a Climate Solution?

The Carbon Offset Potential of Renewable Energy in the First Quarter of the 21st Century

Dr. Adam Serchuk, Renewable Energy Director, Primen
Dr. Evan Hughes, Consultant, Technical Manager for Biomass Support at EPRI

This *Perspective* discusses the use of renewable energy technologies as a climate protection strategy for electric utilities. Drawing on EPRI's proprietary cost and performance data, we compare renewables to alternative methods of avoiding greenhouse gas emissions, and calculate the percentage of electric utilities' emissions that renewables may be able to offset at various price points.

Part I.

Update from the greenhouse:

Carbon policy and markets

U.S. climate policy: Action encouraged but optional

- U.S. law does not currently regulate GHGs
  - 3/01: U.S. declines to ratify *Kyoto Protocol*
- *1605b registry*: Companies may list voluntary reduction measures

Thought experiment for utilities:

What policy would a Gore Administration have had on GHGs?

- *Climate VISION*: 18% reduction in emission intensity by 2012
  - Not actual GHG emissions
- McCain and Lieberman propose federal cap-and-trade for GHGs
  - Senate to debate *Climate Stewardship Act* in Fall of 2003

The states: Some regions moving ahead

- Several states move ahead in the absence of Federal action
  - 6/03: **CT**, **ME** and **MA** sue EPA to have CO_2 regulated under Clean Air Act
  - 7/03: **NY** leads **10 Northeastern states** in developing cap-and-trade regime by April 2005
  - 9/03: **CA**, **OR** and **WA** to collaborate on climate, including renewables
- The chief danger: Incompatible trading systems, less liquidity, and higher compliance prices

International action: Seeking lower prices through greater liquidity

- Kyoto Protocol still alive!
  - U.S. intransigence mobilizes international support
  - Treaty goes into force if Russia ratifies
    - Potential windfall for Russia from “hot air” credits
    - After early announcement of imminent ratification, Pres. Putin now wants more research on economic impacts
- Key interim issue: Will national schemes allow mutual recognition of GHG reduction allowances?
  - 7/03: EU-wide CO_2 cap-and-trade starting 2005
  - Domestic schemes in Denmark and Great Britain
  - Ongoing discussion between EU, Canada, Switzerland (and perhaps also Norway and Japan)

Carbon markets

- Over-the-counter trades for verified GHG reductions
  - Most so far are voluntary and speculative
    - Assume conversion to Kyoto-sanctioned credits in future
  - E.g., Chicago Climate Exchange provides forum trading
    - 22 members include American Electric Power and Manitoba Hydro
    - 9/03: First auction results in <$3.50/metric ton of carbon
- About 54 million metric tons of carbon traded worldwide so far
  - $11 - $29 per metric ton of carbon
  - Many involve call options: right to purchase in future
- Lower international prices if Russia ratifies Kyoto Protocol
- Reductions more expensive in U.S. without international linkages

The caveats:
When is a reduction not a reduction?

- **Additionality:** Will reductions count if they would have happened anyway in the absence of climate policy?
  - E.g., landfill gas projects motivated by odor control
- **Environmental impact:** Should reductions count if they lower GHGs in socially detrimental ways?
  - E.g., NGO opposition to Brazilian Plantar project
- **Double selling:** Can renewable energy be sold as green power, with GHG reductions simultaneously sold in carbon markets?
  - CRS says "no" in its *Green-e* guidelines for tradable credits
- **Double counting:** What if reductions are claimed by both the renewable generator and the conventional generator it displaces?

Part II.

Renewable Energy as a Carbon Solution

Research questions

- How does renewable energy compare to other utility options for reducing GHG emissions?
  - Economically
  - Strategically
- How much can renewables contribute to offsetting utility GHG emissions in the medium term?
- What steps can utilities take to reduce the regulatory risk of future GHG emission policies?

Step #1: Reckon future cost of renewables

- EPRI's *Technical Assessment Guide – Renewable Energy* provides projections to 2025 based on transparent assumptions
  - Cost of capital to utilities
  - Technical progress and cost reductions
  - Resource base (e.g., wind, sun, biomass)
- Sensitivities
  - Wind: Annual average wind speed and turbine vintage
  - Biopower: Delivered fuel cost, installed system cost, and thermal efficiency
  - Photovoltaic: Insolation and installed system cost
  - Geothermal: Annual capacity factor and installed cost of system and well

Step #2: Reckon carbon intensity of base system

Table 1. Carbon intensity of various generating options

Generating option (efficiency)	Carbon (metric tons per MWh)
Coal	
Typical existing (0.341)	0.259
New state-of-the-art pulverized (0.376)	0.236
Advanced IGCC (0.467)	0.190
Natural gas	
Typical existing steam plant (0.331)	0.148
Advanced combustion turbine (0.427)	0.115
Advanced combined cycle (0.538)	0.091
Advanced natural gas fuel cell (0.637)	0.077

IGCC=Integrated gasification combined cycle. Efficiencies in parentheses are at higher heating value (HHV).

Source: EPRI, *Renewable Energy Technical Assessment Guide 2002*, TAG-RE, 1004196 (Palo Alto, CA: EPRI, 2002), Table 10-3.

Assume $42/MWh for new NGCC ($4.00 mmBtu gas) or new advanced pulverized coal ($1.25 mmBtu coal)

Step #3: Reckon cost to avoid carbon emissions by using renewables in 2025

Negative cost
Hot, low-cost geothermal
Class 5+ wind

Low cost
Landfill gas
Existing biopower
Animal waste
Low-cost biomass co-firing
Hot, average-cost geothermal
Class 4 wind

Medium cost
Warm, low-cost geothermal
Good residential PV
Advanced biopower
Medium-cost biomass co-firing
Class 3 wind
Warm, average-cost geothermal

Higher cost
Good central-station PV
Average residential PV
Solar thermal*
Average central-station PV

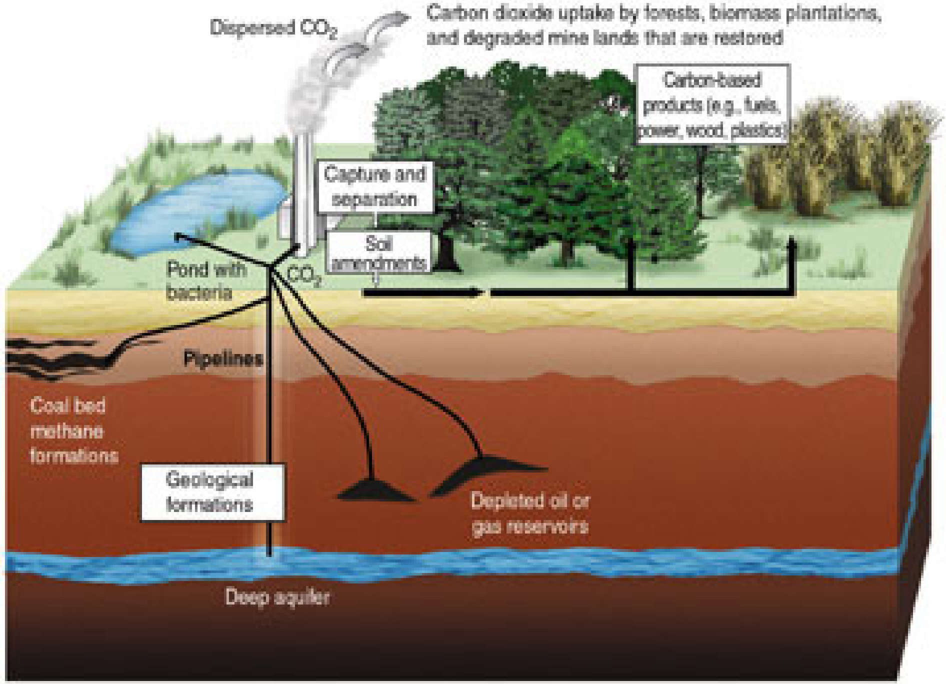
$/metric ton avoided carbon in 2025

	High-C system	Low-C system
Negative	-8	-56
Low	7	96
Medium	51	344
Higher	164	602

Part III.

Compared to What:

The Cost of Alternatives



Alternative means of avoiding GHG emissions

- Efficiency upgrades
  - Potential savings from cost-effective measures
- Forest management
  - Carbon above and below ground, and in forest products
  - Potential revenue from forest products
- Altered farming practices (reduced tillage)
  - More carbon stored in soil, and less released to atmosphere as CO_2
- CO_2 capture and storage
  - Scrubbing flue gas, or CO_2 absorption from goal gasification
  - Sequestration in gas wells, oil wells, coal beds, aquifers or oceans
  - Potential revenue from recovered oil, gas, coal-bed methane

Alternative measures

- Forest management
  - -$160/ton through +$55/ton
- Reduced tillage
  - +$48/ton through +$88/ton
- CO_2 capture and storage
  - +$15/ton through +$143/ton

Source:

B. Bock (TVA), R. Rhudy (EPRI) and H. Herzog (MIT)

Efficiency comparison

Alliance to Save Energy estimates three C&I efficiency measures at -$285/ton through -$120/ton

Conclusions

Reservoirs of low-cost reductions are small

- **Efficiency:** ASE's three selected C&I negative-cost efficiency measures total ~20 million metric tons of avoided carbon
  - Many other efficiency opportunities exist
- **Renewables:** In 2025, about 5.4 – 12.8 million metric tons of avoided carbon from negative-cost opportunities
  - 12 gigawatts of capacity
- **Capture and sequestration:** Perhaps 16 million metric tons of carbon for less than $100/metric ton using <u>today's</u> technology
  - Improved technology would presumably lower prices

Comparison

For 2025, EIA projects U.S. carbon emissions of 2,237 million metric tons

How much?

- Assume 730 million metric tons carbon per year from the U.S. electric power sector in 2025 or so
- Renewables can contribute…

Fraction of U.S. utility sector emissions in 2025	At price...
11%	Under $20/metric ton carbon
23%	Under $80/metric ton carbon
31%	Under $250/metric ton carbon

In other words…

About one quarter of 2025 emissions at competitive price

primen

But price is not the whole story!

- Managing renewables is closer to utilities' **core competencies** than other emission reduction options
  - Utilities retain more control over climate strategy
- Renewable projects can fit into overall **corporate goals**
  - Demonstrate community commitment
  - Build customer loyalty
- Renewable energy is **less risky** than other options
  - We know how much renewables are likely to cost
  - We understand the likely environmental impacts of renewables

Guidance for utilities seeking to reduce regulatory risk

- Identify zero- or low-cost GHG reduction options
  - Emphasize options within core competence
- Obtain access to most attractive reduction resources
  - Consider financial "call" instruments
- Explore implications of various trading regimes
  - Participate in shaping market rules

The challenge:

Design RE programs and products that satisfy both **public and corporate goals**.

For further information…

Adam Serchuk

Director, Renewable Energy

aserchuk@primen.com

tel 608.274.2860

www.primen.com